REMARKS / ARGUMENTS

This application is believed to be in condition for allowance because the claims are non-obvious and patentable over the cited references. The following paragraphs provide the justification for this belief. In view of the following reasoning for allowance, the Applicant hereby respectfully requests further examination and reconsideration of the subject patent application.

1.0 Rejections under 35 U.S.C. §102(b):

In the Office Action of January 20, 2004, claims 1-7, 15, 16, 19, 28, 29 and 33-35 were rejected under 35 U.S.C. §102(b), as being anticipated by Wren, et al. (the article entitled "Pfinder: Real-Time Tracking of the Human Body", hereinafter "***Wren***"). A rejection under 35 U.S.C. §102(b) requires that the Applicant's invention was described in a printed publication more than one year prior to the date of application for patent in the United States. To establish that a patent describes the Applicant's invention, *all of the claimed elements of an Applicant's invention must be considered, especially where they are missing from the prior art*. If a claimed element is not taught in the cited reference, then a rejection under 35 U.S.C. §102(b) is not proper, as the Applicant's invention can be shown to be patentably distinct from the cited reference.

1.1 Rejection of Claims 1-7, 15, 16, 19, 28, 29 and 33-35:

The Office Action rejected independent claims 1, 15, and 34 under 35 U.S.C. §102(b), based on the rationale that the ***Wren*** reference discloses each of the elements of the Applicant's claimed "...system for tracking at least one object in at least one sequential image...," "...process for generating a color-based object model...," and "computer-readable memory for identifying the configuration of objects of interest in a scene," respectively. However, in view of the following discussion, the Applicant respectfully traverses the rejection of independent claims 1, 15, and 34, and thus the rejection of the corresponding dependent claims 6-7, 16, 19, 28, 29, 33, and 35 respectively.

In general, with respect to independent claim 1, the Office Action addresses the first three elements of the Applicant's claimed invention by citing 2, Section 3.1 of the ***Wren*** reference as describing those claimed elements. (Note that independent claims 15 and 34 are rejected using the same explanation, so the discussion provided below will apply equally to independent claims 1, 15 and 34).

In particular, the Office Action first suggests that the ***Wren*** reference discloses "(a) generate a state estimate defining probabilistic configurations of each object for each sequential image..." The Office Action offers page 2, Section 3.1 of ***Wren***, and suggests that this cited text describes determining the blob spatial characteristics of an object in an image, and that this corresponds to generating a state estimate defining probabilistic configurations as illustrated by equation (1). The Office Action next suggests that the ***Wren*** reference discloses "(b) generate observations of pixel color for each sequential image..." The Office Action offers page 2, Section 3.1 of ***Wren***, and suggests that this cited text "describes that each blob has a color component (i.e., generating observations of pixel color)." Next, the Office Action continues by suggesting that the ***Wren*** reference discloses "(c) automatically learn a color-based object model using the state estimate and the observations..." The Office Action offers page 2, Section 3.1 of ***Wren***, and suggests that this cited text "describes that the statistics of the blob are recursively updated to combine information contained in the most recent image with knowledge contained in the priors (i.e., automatically learn a color-based object model)."

However, the Applicant respectfully suggests that the Office Action has incorrectly characterized an alleged capability of the ***Wren*** reference to automatically learn a color-based object model from a combination of generated state estimates and image observations. In fact, the Applicant respectfully suggests that rather than ***learning*** a color-based object model, as described and claimed by the Applicant, the "Pfinder" system described by the ***Wren*** reference provides an iterative process which first ***constructs*** a blob-based model using a pixel comparison process for determining differences between a known background, in combination with a 2D contour tracking system which identifies predefined silhouettes of a person for identifying particular body parts of the person,

including the head, hands, feet, shirt and pants. Different blobs are then used to represent each such body part. Pixels within these blobs are then used as probabilistic priors to identify likely positions of the corresponding body parts in subsequent image frames.

In particular, in stark contrast to the position advanced by the Office Action, Section 3 of the ***Wren*** reference (entitled "**Steady State Tracking**") ***specifically states*** that it will first describe the "steady-state" case for tracking a person where "Pfinder" "***has already found and built representations of the person and scene***." In other words, ***Wren*** states that Section 3.1 assumes that the "person model" has ***already*** been constructed, thus Section 3.1 can ***not*** describe ***learning*** of such models. Initialization of these models is not actually described until Section 4 of the ***Wren*** reference. Clearly, if ***Wren*** explicitly states that Section 3 (including Sections 3.1 through 3.3) describes the case where the ***representations of the person and scene have already been found and built***, then a conflicting interpretation of that description offered by the Office Action should be deemed to be in error.

Therefore, in view of ***Wren's*** own explanation of Section 3, the Applicant respectfully suggests that a more reasonable interpretation of Section 3 through 3.3 of the ***Wren*** reference is that the described "Pfinder" system: 1) uses a recursive statistical approach for ***updating the existing blobs*** used as a "person model" in each image (see Section 3.1); 2) uses a recursive system for updating a "scene model" by "providing an indication of which scene pixels are occluded by the human, and which are visible" (see Section 3.2); and 3) provides an "analysis loop" for interpreting subsequent images given "a person model and a scene model" (see section 3.3). Therefore, in clear contrast to the position advanced by the Office Action, ***Wren*** itself explains that Section 3.1 does ***not learn*** the "person model," but instead merely describes updating the parameters of blobs assigned represent particular parts of the person.

It should be noted that actual construction of the blob-based "person model" and the corresponding "scene model" are described in Section 4 of the ***Wren*** reference. In fact, Section 4 of the ***Wren*** reference is entitled "***Initialization***," with the first paragraph of

Section 4 specifically explaining that the initialization process begins by ***building the scene model*** by observing the scene without people in it, and then ***building up the model of the person*** when a human enters the scene.

In particular, Section 4 (page 4) of the ***Wren*** reference specifically explains the "Pfinder" initialization for ***constructing scene and person models*** as follows:

> "Pfinder's initialization process consists primarily of building representations of the person and the surrounding scene. ***It first builds the scene model by observing the scene without people in it, and then when a human enters the scene it begins to build up a model of that person***.
>
> The person model is ***built up by first detecting a large change in the scene, and then building up a multi-blob model of the user over time***. The model building process is driven by distribution of color on the person's body, with ***blobs added to account for each differently-colored region***. Typically, separate blobs are required for the person's hands, head, feet, shirt, and pants.
>
> The process of building up a blob-model is ***guided by a 2-D contour shape analysis*** that ***recognizes silhouettes in which the body parts can be reliably labeled***. For instance, ***when the user faces the camera and extends both arms... then we can reliably determine the image location of the head, hands and feet. When the user points at something, then we can reliably determine the location of the head, one hand, and the feet***.
>
> ***These locations are then integrated into blob-model building process by using them as prior probabilities for blob creation and tracking.*** For instance, when the face and hand image positions are

identified we can set up a strong prior probability for skin colored blobs." (emphasis added)

The preceding description of the Pfinder tracking system provided by ***Wren*** is unambiguous and clear on its face. Clearly, in Section 4, ***Wren*** explains actual creation of the "person model" by describing a system which begins with some ***known or predefined contours*** corresponding to ***known parts of a human*** (e.g., "The process of building up a blob-model is guided by a ***2-D contour shape analysis*** that ***recognizes silhouettes in which the body parts can be reliably labeled***."). This model (i.e., the collection of blobs) is then iteratively ***updated*** using a conventional "Maximum *A Posteriori* probability (MAP) approach" (see page 1, Introduction), as detailed in Section 3.1, to account for changes in position of the blobs used to represent the various parts of the person throughout a sequence or set of images. In other words, "Pfinder," as described by ***Wren***, identifies known parts of a person by using a 2D contour shape analysis to analyze image frames. Once identified, blobs are then ***assigned*** to represent each identified part of the person. A conventional MAP approach is then used to ***update*** the blobs throughout subsequent images.

Clearly, the above-described approach is ***not*** equivalent to the Applicant's claimed system for ***automatically learning*** "a color-based object model using the state estimate and the observations." In fact, it should be noted that Pfinder merely uses a 2D contour shape analysis to locate ***specific predefined contours*** for identifying particular parts of the person. These located predefined contours are then used as a guide for the assignment of the various blobs used to form the "person model." Again, once this "person model" is created via the ***2D contour shape analysis*** and corresponding blob assignment. The Pfinder system described by ***Wren*** then updates the parameters of the blobs using a conventional MAP approach. Therefore, it should be clear that the ***2D contour shape analysis*** and subsequent blob assignment described by ***Wren*** fails completely to describe a system for ***automatically learning*** "a color-based object model using the state estimate and the observations," as described and claimed by the Applicant.

Consequently, with respect to independent claim 1, the Applicant respectfully suggests that the ***Wren*** reference clearly fails to teach the Applicant's claimed element of "***automatically learn a color-based object model*** using the state estimate and the observations" (emphasis added). Similarly, with respect to independent claim 15, the Applicant respectfully suggests that the ***Wren*** reference again clearly fails to teach the Applicant's claimed element of "***automatically learning the color-based object model*** using the state estimates and the observations" (emphasis added). Finally, with respect to claim 34, the Applicant respectfully suggests that the ***Wren*** reference again clearly fails to teach the Applicant's claimed element of "***automatically learn the color-based object model*** by determining probabilistic relationships between the initial configuration estimates and the pixel color information" (emphasis added). Therefore, in view of the preceding discussion, it is clear that the ***Wren*** process of using ***2D contour shape analysis*** and subsequent blob assignment to create person models fails completely to teach the ***automatic learning*** of object models.

Thus, the present invention, as claimed by independent claim 1, has elements not taught in the ***Wren*** reference. Consequently, the rejection of claim 1 under 35 U.S.C. §102(b) is not proper. Therefore, the Applicant respectfully traverses the rejection of claim 1, and of dependent claims 2-7 under 35 U.S.C. §102(b). Thus, the Applicant respectfully requests reconsideration of the rejection of claims 1-7 in view of the language of claim 1 which recites the following novel language:

> "A system for tracking at least one object in at least one sequential image, comprising:
>
> a general purpose computing device; and
>
> a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to:
>
> (a) generate a state estimate defining probabilistic configurations of each object for each sequential image;

(b) generate observations of pixel color for each sequential image;

(c) ***automatically learn a color-based object*** model using the state estimate and the observations; and

(d) automatically track each object using the learned color-based model with a color-based tracking function." (emphasis added)

Similarly, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 15, also has elements not taught in the ***Wren*** reference. Consequently, the rejection of claim 15 under 35 U.S.C. §102(b) is not proper. Therefore, the Applicant respectfully traverses the rejection of claim 15, and thus of dependent claims 16, 19, 28, 29 and 33 under 35 U.S.C. §102(b). Thus, the Applicant respectfully requests reconsideration of the rejection of claims 15, 16, 19, 28, 29 and 33 under 35 U.S.C. §102(b) in view of the language of claim 15 which recites the following novel language:

"A computer-implemented process for generating a color-based object model, comprising:

generating a state estimate defining probabilistic states of an object for each of at least one sequential images;

generating observations of pixel color for each sequential image; and

automatically learning the color-based object model using the state estimates and the observations" (emphasis added)

Finally, in view of the preceding discussion, it is clear that the present invention, as claimed by independent claim 34, also has elements not taught in the ***Wren*** reference. Consequently, the rejection of claim 34 under 35 U.S.C. §102(b) is not proper. Therefore, the Applicant respectfully traverses the rejection of claim 34, and thus of dependent claim 35 under 35 U.S.C. §102(b). Thus, the Applicant respectfully requests reconsideration of the rejection of claims 34-35 under 35 U.S.C. §102(b) in view of the language of claim 34 which recites the following novel language:

"A computer-readable memory for identifying the configuration of objects of interest in a scene, comprising:

a computer-readable storage medium; and

a computer program comprising program modules stored in the storage medium, wherein the storage medium is so configured by the computer program that it causes the computer to,

generate an initial configuration estimate for objects of interest within the scene,

identify pixel color information within the scene that is relevant to a learned color-based object model,

automatically learn the color-based object model by determining probabilistic relationships between the initial configuration estimates and the pixel color information, and,

generate a final configuration estimate for objects of interest in the scene by using the color-based object model in combination with a color-based tracking function." (emphasis added)

2.0 Rejections Under 35 U.S.C. §103(a):

In the Office Action of January 20, 2004, claims 8, 10, 13, 14, 17, 18 and 20-22 were rejected under 35 U.S.C. §103(a) as being unpatentable over ***Wren*** in view of Birchfield (the article entitled "Elliptical Head Tracking Using Intensity Gradients and Color Histograms", hereinafter "***Birchfield***"). In addition, claims 9, 36, and 37 were rejected under 35 U.S.C. §103(a) as being unpatentable over ***Wren*** in view of ***Birchfield*** and in further view of Koller, et al, (the article entitled "Using Learning for Approximation in Stochastic Processes", hereinafter "***Koller***").

However, in order to deem the Applicant's claimed invention unpatentable under 35 U.S.C. §103(a), a prima facie showing of obviousness must be made. However, as fully explained by the M.P.E.P. Section 706.02(j), to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or

motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, ***the prior art reference (or references when combined) must teach or suggest all the claim limitations***.

Further, in order to make a prima facie showing of obviousness under 35 U.S.C. 103(a), ***all of the claimed elements of an Applicant's invention must be considered, especially when they are missing from the prior art***. If a claimed element is not taught in the prior art and has advantages not appreciated by the prior art, then no prima facie case of obviousness exists. The Federal Circuit court has stated that it was error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein (*In Re Fine*, 837 F.2d 107, 5 USPQ2d 1596 (Fed. Cir. 1988)).

2.1 Rejection of Claims 8, 10, 13, 14, 17, 18 and 20-22:

The Office Action rejected dependent claims 8, 10, 13, 14, 17, 18 and 20-22 under 35 U.S.C. 103(a) based, in part, on the rationale that while ***Wren*** failed to disclose the use of histogram processing, this element is disclosed by ***Birchfield***, and that it would therefore be obvious to modify ***Wren*** by adding the use of histogram processing as taught by ***Birchfield*** to teach the Applicants claimed invention.

However, in accordance with the preceding discussion regarding independent claims 1 and 15, it is clear that ***Wren*** fails to disclose the ***automatic learning of color-based object models*** as described and claimed by the Applicant, and that in fact, claims 1 and 15 of the Applicant's invention have been shown to be patentable under 35 U.S.C. §102(b). Consequently, the addition of the alleged ***Birchfield*** histogram processing to the create the proposed ***Wren-Birchfield*** combination reference still fails completely to disclose the Applicant's claimed element of ***automatically learning color-based object models***. In fact, where the parent claim has been shown to be patentable, the use of a

secondary reference to address a particular element of a dependent claim does not satisfy the requirements of either M.P.E.P. Section 706.02(j), or 35 U.S.C. §103(a).

Therefore, the rejection of claims 8, 10, 13, 14, 17, 18 and 20-22 under 35 U.S.C. §103(a) fails to meet the requirements of M.P.E.P. Section 706.02(j). In particular, the proposed ***Wren-Birchfield*** combination fails to teach all of the elements of the claimed invention. This lack of a prima facie showing of obviousness means that rejected claims 8, 10, 13, 14, 17, 18 and 20-22 are patentable under 35 U.S.C. §103(a). Thus, the Applicant respectfully traverses the rejection of claims 10, 13, 14, 17, 18 and 20-22, and requests reconsideration of the rejection of those claims under 35 U.S.C. §103(a). The basis for this patentability is the nonobvious language of independent claims 1 and 15, respectively, as cited above.

2.2 Rejection of Claims 9, 36 and 37:

The Office Action rejected dependent claims 9, 36 and 37 under 35 U.S.C. 103(a) based, in part, on the rationale that while ***Wren*** failed to disclose the use of histogram processing, this element is disclosed by ***Birchfield***, and the use of probability distribution functions, such as Dirichlet functions, is taught by ***Koller***, and that it would therefore be obvious to modify ***Wren*** by adding the use of histogram processing as taught by ***Birchfield***, and the use of a Dirichlet function as taught by ***Koller*** to teach the Applicant's claimed invention.

However, in accordance with the preceding discussion regarding independent claims 1, 15 and 34, it is clear that ***Wren*** fails to disclose the automatic learning of color-based object models as described and claimed by the Applicant, and that in fact, claims 1, 15 and 34 of the Applicant's invention have been shown to be patentable under 35 U.S.C. §102(b). Consequently, the addition of the alleged ***Birchfield*** histogram processing and alleged ***Koller*** Dirichlet function to the create the proposed ***Wren-Birchfield-Koller*** combination reference still fails completely to disclose the Applicant's claimed element of ***automatically learning color-based object models***. In fact, where the parent claim has

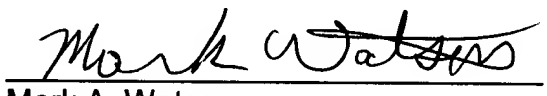
been shown to be patentable, the use of a secondary reference, or references, to address a particular element of a dependent claim does not satisfy the requirements of either M.P.E.P. Section 706.02(j), or 35 U.S.C. §103(a).

Therefore, the rejection of claims 9, 36 and 37 under 35 U.S.C. §103(a) fails to meet the requirements of M.P.E.P. Section 706.02(j). In particular, the proposed ***Wren-Birchfield-Koller*** combination fails to teach all of the elements of the claimed invention. This lack of a prima facie showing of obviousness means that rejected claims 9, 36 and 37 are patentable under 35 U.S.C. §103(a). Thus, the Applicant respectfully traverses the rejection of claims 9, 36 and 37, and requests reconsideration of the rejection of those claims under 35 U.S.C. §103(a). The basis for this patentability is the nonobvious language of independent claims 1 and 34, respectively, as cited above.

CONCLUSION

In view of the above, it is respectfully submitted that claims 1-43 are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 1-10, 13-22, 28, 29, and 33-37. Further, as the patent claims of claims 11-12, 23-27, 30-32, and 38-43 have been shown to be patentable, the Examiner is respectfully requested to withdraw the outstanding objection to claims 11-12, 23-27, 30-32, and 38-43, and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the Applicant kindly invites the Examiner to telephone the Applicant's attorney at (805) 278-8855 if the Examiner has any questions or concerns.

Respectfully submitted,



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